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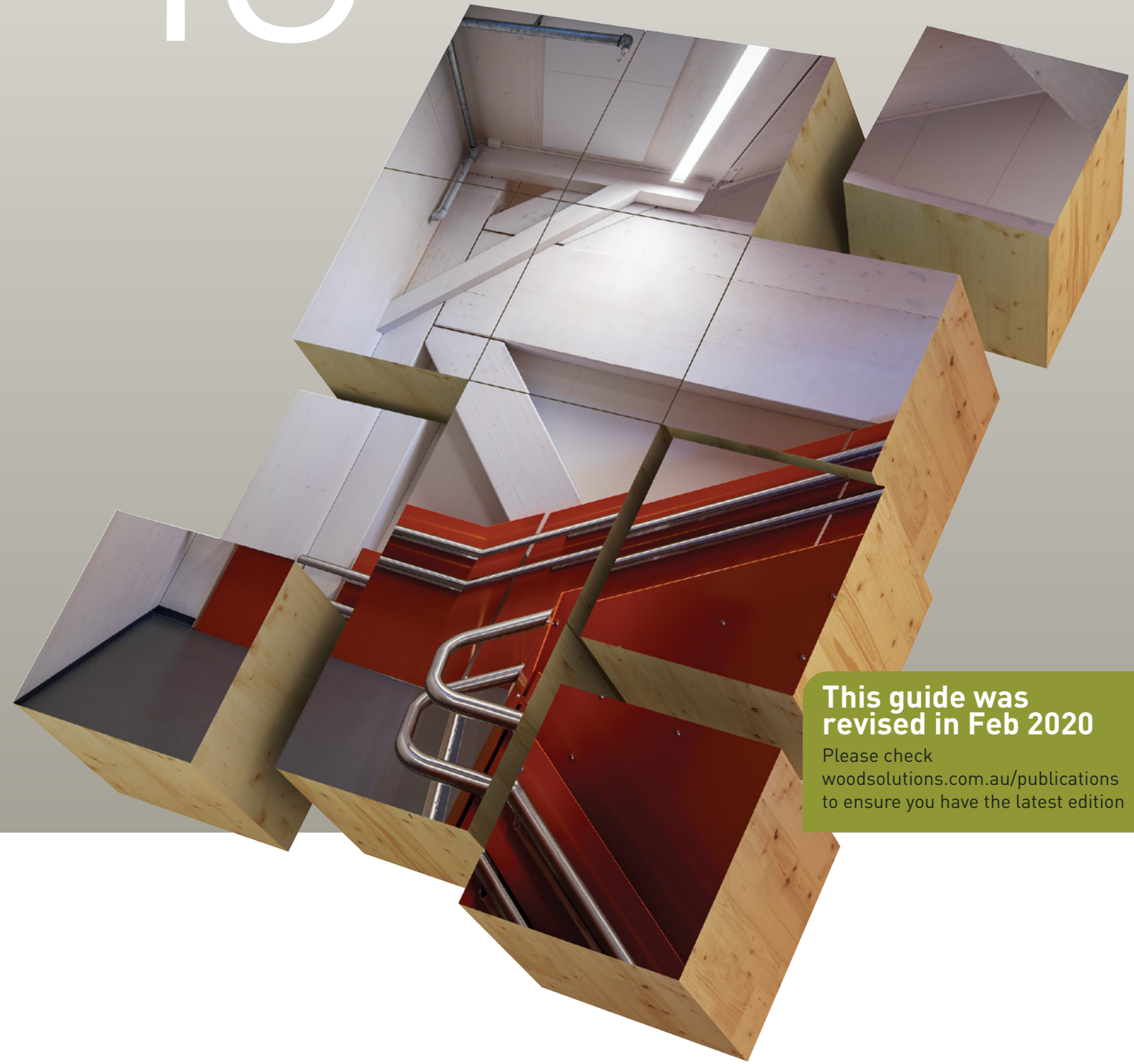

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# Code of Practice

## *Fire Retardant Coatings Applied to Wood Products*

Technical Design Guide issued by Forest and Wood Products Australia


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WoodSolutions is an industry initiative designed to provide independent, non-proprietary information about timber and wood products to professionals and companies involved in building design and construction.

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**Researchers**
Paul England EFT Consulting,
PO Box 1288, Upwey, 3158 VIC
paul.england@eftconsult.net

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# 1 Introduction

**The primary purpose of this Code of Practice (CoP) for Fire-retardant Coatings Applied to Wood Products is to supplement the National Construction Code[1] (NCC) and relevant State and Territory Legislation by addressing issues relating to the supply, evidence of suitability, installation and maintenance of fire-retardant coatings used to modify the reaction to fire performance of wood products in greater detail. If there is any conflict between this CoP, the NCC or other relevant building legislation, the order of precedence is:**

- **State and Territory Legislation**
- **National Construction Code**
- **The Code of Practice**

**Notwithstanding the above, other legislation such as Workplace Health and Safety and Common Law obligations also apply to individuals and companies involved in the supply chain, design, and construction of buildings and components within buildings and the subsequent operation and maintenance of buildings.**

**These organisations must ensure that they adequately discharge their duty of care to ensure the building and its components are fit for purpose, comply with relevant legislation and do not pose an unacceptable level of risk to the health and safety of people.**

Typical fire-retardant coatings are:

- Paints and varnishes
- Intumescent coatings
- Encapsulation coating systems
- Surface treatments with liquids

Fire-retardant coatings form part of a system comprising a wood product substrate, the fire-retardant coatings, and primers, undercoats and top coats if used in conjunction with the fire-retardant.

Parts of this Guide are also relevant to other fire-retardant treatments such as impregnation.

## Compliance with the National Construction Code (NCC)

In order to comply with the NCC it must be demonstrated that the Governing Requirements of the NCC and the Performance Requirements have been satisfied.

The Governing Requirements of the NCC are documented in Section A of the NCC and provide rules and instructions for using and complying with the NCC including:

- Interpreting the NCC
- Complying with the NCC
- Application of the NCC in States and Territories
- Applying documents referenced in the NCC
- Documenting the suitability of the design, construction and/or use of materials to comply with the NCC
- Classifying buildings by their characteristics and intended use.

The performance requirements can be satisfied by means of a Performance Solution or a Deemed-to-Satisfy Solution or a combination as shown schematically in Figure 1.

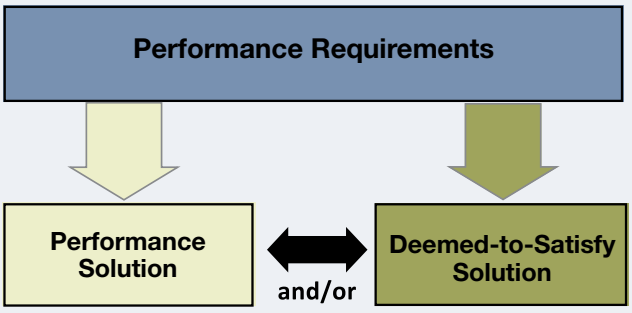


*Figure 1: Pathways for demonstrating compliance with NCC Performance Requirements.*

Compliance of a Performance Solution can be achieved by demonstrating compliance with all relevant performance requirements or demonstrating the solution is at least equivalent to the Deemed-to-Satisfy Provisions.

The NCC 2019 Deemed-to-Satisfy Provisions prohibit the use of fire-retardant coatings to achieve compliance with the fire hazard properties. Specifically, Clause C1.10 (b) states:

"Paint or fire-retardant coatings must not be used to achieve compliance with the required fire hazard properties".

Clause C1.10(a) identifies the following internal linings, materials and assemblies within a Class 2 to 9 building to which the fire hazard properties apply:

- Floor linings and floor coverings
- Wall linings and ceiling linings
- Air-handling ductwork
- Lift cars
- fixed seating in the audience area or auditorium and some proscenium curtains in Class 9b buildings used as a theatre, public hall or the like
- Escalators, moving walkways and non-required non-fire-isolated stairways or pedestrian ramps subject to Specification D1.12
- Sarking-type materials
- Attachments to floors, ceilings, internal walls, common walls, fire walls and to internal linings of external walls
- Other materials including insulation materials other than sarking-type materials.

It should be noted that there are a number of State variations to Clause C1.10a of the NCC and these take precedence for buildings that are constructed within these jurisdictions.

***If the above prohibition applies, a Performance Solution will need to be developed if fire-retardant-coatings are to be used to achieve compliance with the required fire hazard properties unless specifically excluded by State or Territory variations.***

Guidance on the development of performance solutions is available in other WoodSolutions documents and on the ABCB web site (abcb.gov.au)

The NCC does however permit the use of other fire-retardant treatments to achieve compliance with the fire hazard properties such as impregnation and also allow fire-retardant coatings to be applied to timber products to achieve compliance with certain Bushfire Provisions of AS 3959.

## Typical Roles & Responsibilities for the Design, Construction and Operation of Buildings

Figure 2 is an indicative schematic showing typical roles and responsibilities for the design, construction and subsequent operation of buildings to provide a context for this Design Guide. The flow chart also identifies key documentation in order to facilitate the design and specification of fire-retardant treatments that are fit for purpose and provide evidence of suitability.

Four main processes are identified in Figure 2.

- Building Design
- Construction
- Compliance Checking
- Building Use and Occupation

For simplicity, Figure 2 shows a linear process but in reality, design modifications may be necessary throughout a building project and numerous iterations may occur. ***It is essential that all design changes are fully documented, and the modified design checked for compliance with appropriate evidence of suitability obtained.***

State government bodies and / or local councils have responsibilities for ensuring industry compliance with relevant building regulations; generally through accreditation or licensing of practitioners and audits of typical projects.

## Building Design Process

The Building Design Process will typically be undertaken by a design team led by a consultant such as the project architect. The design team composition will depend up the needs of the project. For projects where fire related performance solutions are being considered, a fire safety engineer would form part of the design team and a Performance Based Design Brief (PBDB) Committee containing relevant stakeholders will normally be established. Refer to the above section 'Compliance with the National Construction Code (NCC)' for further information.

The outcome of the design process will be plans and technical specifications that should, amongst other things, define the required performance and evidence of suitability for various components, such as fire-retardant coatings, in order to satisfy the NCC Performance Requirements and other critical design objectives. Some key considerations are identified in the following section 'Typical Design Considerations' with more detailed information provided in Sections 2 to 5 of the Guide.

The design documentation is then submitted to the relevant authority (e.g. building surveyor / certifier) for approval.

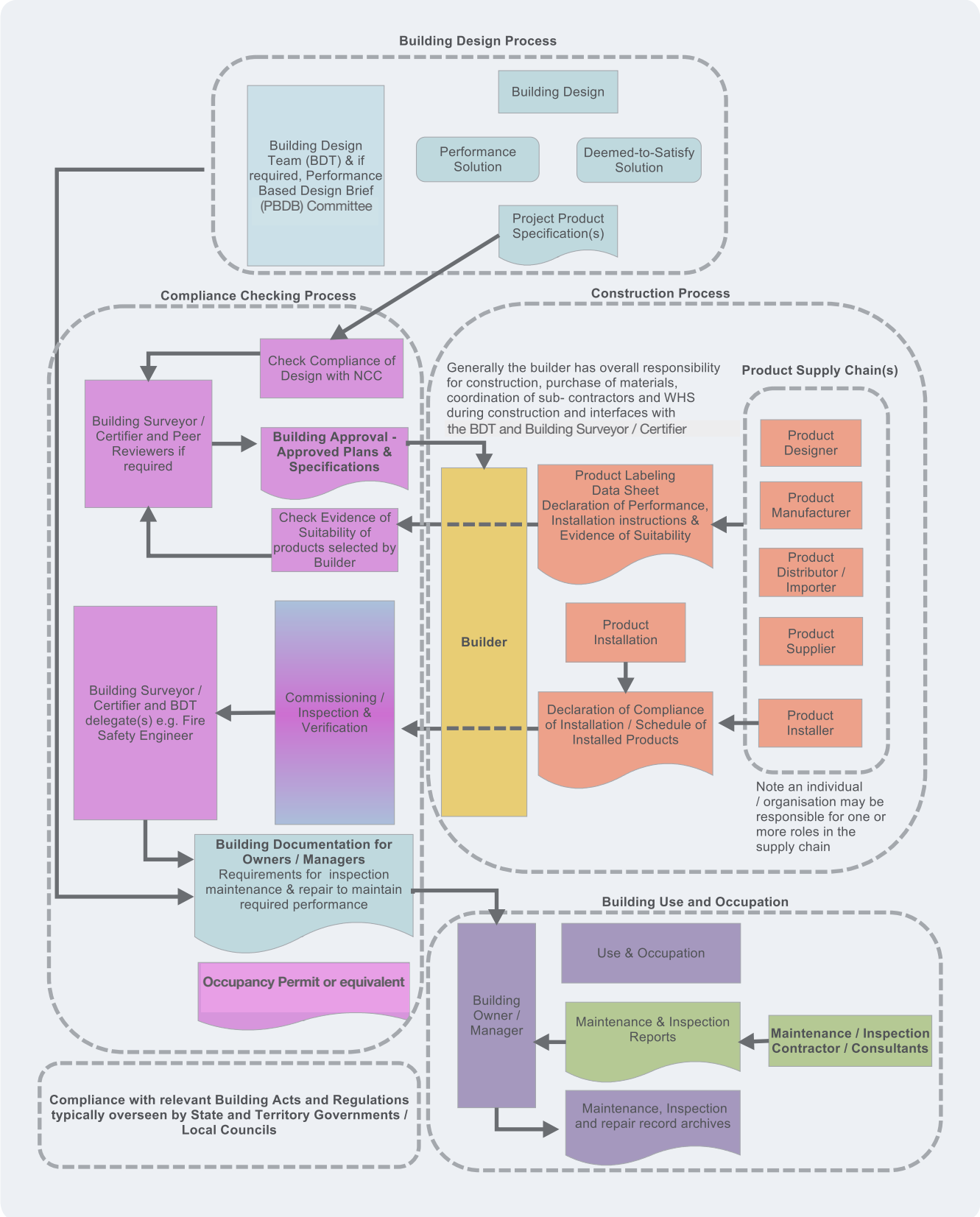


***Figure 2: Typical roles & responsibilities for the design, construction and operation of buildings.***

## Compliance Checking Process

Compliance checking must be undertaken throughout the project including the design and construction phases through to hand over and involves close liaison with the building design team. Commissioning inspection and verification of final installations form a critical part of the process.

It is important that roles and responsibilities are clearly defined at the start of the project to ensure critical inspections / verification processes and necessary design checks are undertaken.

Building Acts and Regulations in the States and Territories specify administrative procedures for determining compliance and granting approval for building works to be undertaken and subsequently for buildings to be occupied.

## Construction Process

A builder is generally responsible for implementing the design including purchase of materials but may rely on specialist sub-contractors to undertake installation of systems such as fire-retardant coatings. On large or complex projects, the builder will have to manage multiple product supply chains and act as a conduit for evidence of suitability and other compliance documentation to the design teams and compliance checkers notwithstanding information from the supply chain may have been provided to designers during the design phase independently.

The supply chain for fire-retardant coatings for wood products is the main focus of this design guide with critical documentation to facilitate compliance checking including;

- Product labelling
- Product Data Sheets
- Declaration of Performance
- Installation Instructions
- Evidence of Suitability
- Declaration of Compliance of Installation and Schedule of Installed products.

This is addressed further in Section 6.

## Building Use and Occupation

Information relating to requirements for maintenance and inspection to ensure that the performance is maintained at the required level throughout the life of a building and if damaged rectification works can be undertaken. This is addressed in more detail in Section 7.

# Typical Design Considerations

## General Considerations

When considering the use of a fire-retardant coating in order to comply with the NCC, it is necessary to determine amongst other things:

- how the coating can be installed / constructed safely without unnecessary disruption to other site activities
- how the substrate will be prepared, and the coating applied to achieve the required performance
- how the correct application of the coating will be verified
- what is the minimum design life of the fire-retardant system?
- what measures are required to ensure that the performance of the substrate and coating are maintained throughout the design life of the system (inspection and repair)?
- measures to be taken to ensure the coating does not present a hazard during renovation / modification or demolition
- measures to be taken to ensure that the coating is not compromised during the renovation / modification process
- what evidence of suitability is required?
- how the performance of the coating can be re-instated, or the design life extended at the end of the specified coating design life particularly if it is less than the design life of the building?

Many of these matters are not specifically addressed in the NCC but they are inferred under Clause A5.0 of the NCC which states:

*"A5.0 Suitability*

*(1) A building and plumbing or drainage installation must be constructed using materials, products, plumbing products, forms of construction and designs fit for their intended purpose to achieve the relevant requirements of the NCC."*

## Responsibilities for Safe Design

In addition, Workplace Health and Safety Legislation is also applicable which requires safe design principles to be applied. A Code of Practice on the safe design of structures has been published by Safe Work Australia[2] which provides guidance to persons conducting a business or undertaking who design structures that will be used, or could reasonably be expected to be used, as a workplace. It is prudent to apply these requirements generally since most buildings will be a workplace for people undertaking building work, maintenance, inspections even if the building is not primarily used as a workplace.

The Safe Design of Structures Code of Practice defines Safe design as;

*"the integration of control measures early in the design process to eliminate or, if this is not reasonably practicable, minimise risks to health and safety throughout the life of the structure being designed"*

***For further details on how to address WHS requirements refer to Model Code of Practice: Safe Design of Structures published by Safe Work Australia.***

It indicates that safe design begins at the start of the design process when making decisions about:

- the design and its intended purpose
- materials to be used
- possible methods of construction, maintenance, operation, demolition or dismantling and disposal
- what legislation, codes of practice and standards need to be considered and complied with.

The Code of Practice for Safe Design of Structures also provides clear guidance on who has health and safety duties in relation to the design of structures and lists the following practitioners:

- architects, building designers, engineers, building surveyors, interior designers, landscape architects, town planners and all other design practitioners contributing to, or having overall responsibility for, any part of the design
- building service designers, engineering firms or others designing services that are part of the structure such as ventilation, electrical systems and permanent fire extinguisher installations
- contractors carrying out design work as part of their contribution to a project (for example, an engineering contractor providing design, procurement and construction management services)
- temporary works engineers, including those designing formwork, falsework, scaffolding and sheet piling
- persons who specify how structural alteration, demolition or dismantling work is to be carried out.

In addition, WHS legislation places the primary responsibility for safety during the construction phase on the builder.

From the above, it is clear that the design team in conjunction with owners / operators and the builder have a responsibility to document designs, specify and implement procedures that will minimise risks to health and safety throughout the life of the structure being designed.

## Other Design Considerations

Designers need to take account of a broad range of design considerations to ensure that a building is fit for purpose and complies with all requirements of the NCC. Issues such as durability and weatherproofing may also apply to fire-retardant coatings particularly if used in external applications.

Clients may require specific issues to be addressed such as the impact on the environment.

## Checking Interpretations of Regulations and Standards

Whilst this CoP focusses of NCC compliance of wood products protected by fire-retardant coatings, it should be noted that the NCC provides a uniform set of technical provisions for the design and construction of buildings and other structures throughout Australia. The NCC does not regulate matters such as the roles and responsibilities of building practitioners and maintenance of fire safety measures which fall under the jurisdiction of the States and Territories.

State and Territory Building legislation is not consistent in relation to these matters with significant variations with respect to:

- registration and licencing of practitioners,
- mandatory requirements for inspections during construction, and
- requirements for maintenance of fire safety measures.

In addition, changes to legislation are not necessarily linked to the NCC revision cycle. Therefore, current Common Law, State and Territory Building Acts and Regulations and Workplace Health and Safety Legislation should be checked for the specific jurisdiction that will apply to a building or product.

# 2 Fire Tests for Wood Products Protected by Fire-retardant Coatings Relevant to the NCC

**This Section provides an overview of typical fire tests / classification standards specified by the NCC that may be used to evaluate wood products or systems protected by fire-retardant coatings.**

## NCC Classification Requirements for Fire Hazard Properties

The requirements for Fire Hazard Properties are prescribed in Specification C1.10 of the NCC in relation to linings, materials and assemblies. The applications most relevant to fire-retardant coated wood products are:

- Wall and Ceiling Linings classified in accordance with AS 5637.1[3]
- Floor linings classified in terms of the critical heat and smoke developed rate determined in accordance with AS ISO 9239.1[4]
- Miscellaneous materials / assemblies and attachments classified in terms of Smoke Developed and Spread of Flame indices determined in accordance with AS 1530.3[5]
- Building elements in Bushfire Prone Areas in accordance with AS 3959[6].

Further details of the applicable fire test methods and criteria are provided below.

## Wall and Ceiling Linings – AS 5637

The fire hazard properties of wall and ceiling linings are determined in accordance with AS 5637.1. Materials are classified in terms of a *group number* determined by undertaking a large scale test in accordance with AS ISO 9705—2003[7] or, if the material has a confirmed correlation in accordance with AS 5637.1, the *group number* can be predicted based on data from bench scale tests performed at an imposed irradiance in the horizontal orientation of 50 kW/m$^2$ in accordance with AS/NZS 3837[8] or ISO 5660-1[9].

Supplementary smoke production criteria are specified in terms of the *smoke growth rate index* or *average specific extinction area*, depending on the test methods adopted.

Acceptable correlations exist for wood products and bench scale tests are normally sufficient for most homogeneous wood products.

Figure 3 shows a whole room assembly lined with the system to be evaluated being tested in accordance with AS ISO 9705. Figure 4 shows a specimen being subjected to a bench scale test in accordance with AS/NZS 3837.

***Figure 3: AS ISO 9705 fire tests.***

***Figure 4: AS/NZS 3837 Cone Calorimeter test.***

Wall and Ceiling linings are classified on the following basis.

Group 1—material that does not reach flashover when exposed to 100 kW for 600 s followed by exposure to 300 kW for 600 s.

Group 2—material that reaches flashover following exposure to 300 kW within 600 s after not reaching flashover when exposed to 100 kW for 600 s.

Group 3—material that reaches flashover in more than 120 s but within 600 s when exposed to 100 kW. Most unprotected wood products achieve this level of performance.

Group 4—material that reaches flashover within 120 s when exposed to 100 kW.

In addition, the following smoke production criteria apply depending upon the test method adopted unless the building is protected by a sprinkler system complying with Specification E1.5 (other than a FPAA101D or FPAA101H system).

AS ISO 9705: a *smoke growth rate index* not more than 100; or

AS/NZS 3837: an *average specific extinction area* less than 250 $m^2$/kg.

Most wall and ceiling linings of solid timber 19 mm thick are expected to achieve Group 3 performance. Some timber species of 9 mm thickness have also achieved Group 3 performance - Refer the WoodSolutions “fire test reports” webpage.

Fire-retardant treatments can be used to improve the performance of wood products in order to achieve Group 1 and Group 2 classifications.

## Floor Linings and Coverings - AS ISO 9239.1

The fire hazard properties of floor linings and coverings are determined by undertaking tests in accordance with AS ISO 9239.1[10] to determine the *critical radiant flux* at extinguishment and the *smoke development rate*.

The test apparatus and a typical fire test are shown in Figure 5.

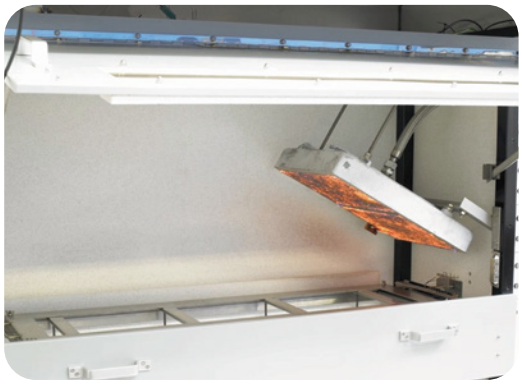

***Figure 5: AS ISO 9239.1 fire testing.***

Three levels of *critical heat flux* are prescribed in Specification C1.10 of the NCC

- 1.2 kW/$m^2$ applies to the most hazardous materials
- 2.2 kW/$m^2$ is an intermediate level of performance
- 4.5 kW/$m^2$ applies to the least hazardous.

Most wood products achieve a *critical heat flux* greater than 2.2, which satisfies the NCC Deemed-to-Satisfy requirements for most applications except for fire isolated exits and fire control rooms in some healthcare-buildings and patient / general areas in some healthcare-buildings that are not provided with automatic fire sprinkler systems – refer NCC Specification C1.10 for further information.

For most applications, fire-retardant coatings will not be required to enhance the performance of wood products to satisfy the NCC Deemed-to-Satisfy requirements.

A maximum *smoke development rate* limit of 750 percent-minutes is also required to be satisfied in buildings not protected by a sprinkler system complying with Specification E1.5 (other than an FPAA 101D or FPAA 101H). Most wood products will satisfy this criterion.

## Attachments and Miscellaneous Applications – AS 1530.3

AS 1530.3[5] is used to classify the fire hazard properties of attachments and materials used for other miscellaneous applications – refer NCC C1.10 for a full list of applications to which this standard is applied.

For materials other than sarking, there is separate range of fire performance indicators termed Early Fire Hazard Indices: The *Spread-of-Flame Index* and *Smoke-Developed Index* are used by the NCC for classification of purposes.

Typical NCC deemed-to-satisfy requirements are summarised in Table 1.

***Table 1: AS 1530.3 indices applied to attachments and other materials.***

| Material or assembly location | Element | Spread-of-Flame Index | Smoke-Developed Index |
|---|---|---|---|
| Fire control rooms[1] and fire-isolated exits | - | 0 | 2 |
| Class 9b buildings used as a theatre, public hall or similar | Fixed seating in the audience area or auditorium. | 0 | 5 |
| | A proscenium curtain[2] | 0 | 3 |
| Escalators, moving walkways or non- required non- fire-isolated stairways or pedestrian ramps[3] | - | 0 | 5 |
| Insulation materials other than sarking-type materials | - | 9 | 8 if the Spread-of-Flame Index is more than 5 |
| All other materials or locations | - | 9 | 8 if the Spread-of-Flame Index is more than 5 |

*Note:*
*1. Required by Specification E1.8*
*2. Required by Specification H1.3.*
*3. Required by Specification D1.12.*

Most unprotected wood products are expected to achieve a *Spread of Flame Index* between 3 and 9 and a *Smoke Developed Index* less than 5. A notable outlier is unprotected Western Red Cedar with a *Spread of Flame Index* of 10. Further test data is provided on the WoodSolutions site – search “fire test reports”.

## AS 3959 Requirements for Bushfire-Resisting Timber

AS 3959[6] allows the use of bushfire-resisting timber for BAL levels up to BAL-29, subject to compliance with Appendix F of the standard.

Bushfire-resisting timber may be solid, laminated or reconstituted form and may be ‘bushfire-resisting’ by means of one or more of:

- the inherent properties of the material itself
- being impregnated with fire-retardant chemicals
- the application of fire-retardant coatings or substrates.

Where the timber has been altered by chemicals or protected by a coating, the test samples are required to be exposed to accelerated weathering prior to fire testing unless the timber is protected from the weather, as described in AS 1684.2[11] and AS 1684.3[12].

External wood products are deemed to be protected from the weather if they are covered by a roof projection (or similar) at 30° or greater to the vertical and they are well detailed and maintained (painted or stained and kept well ventilated).

AS 3959 also allows elements of construction to be tested to AS 1530.8.1[13] and AS 1530.8.2.[14] to provide evidence of suitability for use in accordance with the NCC when exposed to appropriate bushfire attack levels. Fire-retardant coated wood products may form part of these systems.

## Fire Testing of Bushfire-Resisting Timber – AS/NZS 3837

In order to determine if a protected or unprotected wood product satisfies the requirements for bushfire-resisting timber, samples are fire tested in accordance with AS/NZS 3837 and are required to satisfy the following criteria:

- the maximum heat release rate shall be not greater than 100 kW/m$^2$
- the average heat release rate for 10 min following ignition shall be not greater than 60 kW/m$^2$ when the material is exposed to an irradiance level of 25 kW/m$^2$.

## AS 3959 Requirements for Accelerated Weathering Prior to Fire Testing Bushfire-Resisting Timber

If an element protected by a fire-retardant coating is likely to be fully exposed to weather, accelerated weathering is required before testing to AS/NZS 3837. AS 3959 specifies the following accelerated weathering regime:

The fire-retardant-coated substrates need to be subjected to the ASTM D2898[15] Method B weathering regime, but with the water flow rate modified to be the same as that within ASTM D2898 Method A.

## Fire Testing Elements of Construction Exposed to Bushfire Attack AS 1530.8.1

AS 1530.8.1 is a large-scale test method to evaluate the performance of elements of construction exposed to simulated bushfire attack.

The principle of the test is that a representative element of construction is subjected to an imposed radiant heat flux in conjunction with small flaming sources. The test method allows for different radiant heat exposure levels to enable the method to be applied to different bushfire attack levels (BALs). The radiant heat flux is varied with time to simulate the passage of the flame front.

During the test, a pilot ignition source is applied to exposed combustibles and volatiles on the exposed face simulating ember attack. Burning cribs are also applied on surfaces where there is potential for debris accumulation. Conditions are monitored during exposure to radiant heat and for a further period of 60 minutes following radiant heat exposure to identify potentially persistent hazardous conditions.

If all the performance criteria are satisfied a BAL rating is assigned based on the incident radiant heat applied during the test. Available BAL ratings are BAL 12.5,19, 29 and 40.

BAL–FZ applies to elements of construction potentially exposed to full flame engulfment from the fire front and specimens can be evaluated using AS 1530.8.2 which uses similar conditions to a standard fire resistance test and therefore use of fire-retardants is not common.

## Combustible External Cladding Systems AS 5113

The NCC 2019 edition Deemed-to-Satisfy requirements generally require cladding systems for external walls to be non-combustible. Where combustible cladding systems are intended to be used a Performance Solution will be required.

AS 5113 Fire propagation testing and classification of external walls of buildings[16] specifies test methods, performance criteria and classification procedures that can be applied to combustible cladding systems.

The nominated test methods include ISO 13785.2[17] and BS 8414 Parts 1 and 2[18].

***Figure 6: ISO 13785.2 test configuration.***

AS 5113 is referenced in the NCC Volume One Amendment 1 Verification Method CV3, and enables industry to verify the fire performance of external cladding systems against the relevant Performance Requirements of the NCC. This seeks to improve compliance, promote innovative solutions and ensure the required fire performance is achieved.

Therefore if timber external cladding systems are intended to be used AS 5113 is the most appropriate method of evaluation of a façade system forming part of a Performance Solution.

# 3 Selection of Fire Test Configurations

## End use of Fire-retardant Coatings

While fire-retardant coatings may be supplied independently of a wood product substrate, the coating forms part of an element of construction that includes a wood product substrate, the fire-retardant coatings, and primers, undercoats and top coats.

In many applications the reaction to fire performance of elements of construction also depends on fixings (including adhesives), the thickness of the substrate and backing details such as air cavities or insulation within the element.

Fire-retardant coatings should be fire tested in a manner that reflects their intended end use. This may require more than one test to cover a broad range of applications. Typical variations include:

- a range of wood products (timber species / type engineered products)
- substrate thicknesses
- cavity detail / backing materials
- different levels of performance / end use application
- fire-retardant coatings application rate
- primers types and application rates
- undercoats and application rates
- top coats and application rates
- presence of cavity barriers (when testing full scale facades).

ISO 14697[19] provides guidance on the choice of substrates for testing including specification of a 'standard' non-fire-retardant treated particleboard substrate.

## Field of Application

It is recommended that fire-retardant suppliers define a target field of application for their fire-retardant products and liaise with a registered testing authority to define a cost effective test program prior to undertaking any significant fire testing. At the end of the test program an assessment from an Accredited Testing Laboratory confirming the field of application for the product based on referenced test data should be obtained in a format that is consistent with the evidence of suitability required by the NCC.

# 4 Durability

## Relevant NCC Deemed-to-Satisfy Provisions

The National Construction Code 2019 provides limited guidance and Deemed-to-Satisfy requirements in relation to durability. With respect to fire-retardant coatings, the NCC Deemed-to-Satisfy requirements relating to bushfire specify compliance with AS 3959[6], which explicitly addresses the durability of fire-retardant coatings through the specification of accelerated weathering tests prior to fire testing of bushfire-resisting timber if the element is to be used in a position fully exposed to weather. This provides a useful benchmark.

NCC Clause 5.0 - Suitability provides a general fit-for-purpose statement that effectively requires matters such as durability to be addressed.

General advice relating to the durability of timber is provided in WoodSolutions Technical Design Guide #5 *Timber service life design - Design guide for durability*[20].

This CoP considers durability with respect to the fire properties of timber components with fire-retardant coatings applied.

## ABCB Handbook - Durability in Buildings including Plumbing Installations

The Australian Building Codes Board has published a Handbook on the Durability in Buildings Including Plumbing Installations[21] to provide construction industry participants with non-mandatory advice in general terms to be used to develop solutions relevant to specific situations. The Handbook indicates that industry is expected to develop specific solutions relevant to specific materials using the principles and criteria within the handbook.

However, the Handbook indicates that it is not intended to:

- override or replace legal rights, responsibilities or requirements
- provide users with the specifics of the NCC
- address the issue of durability in terms of consumer protection.

## Design Life For Building Components

The Handbook states that the minimum design life for a building or plumbing installation and the components of their subsystems should be as shown in Table 2 and that the design life of buildings shall be taken as ‘Normal’ for all building importance categories unless otherwise specified. The content of this CoP is based on a building design life of 50 years.

Most applications for which fire-retardant coatings are used are expected to be readily accessible or moderately accessible. For example, a corridor lining within a building would generally be considered readily accessible whereas timber components forming part of an external façade of a mid-rise building may be considered to have a moderate ease of access (unless the building design provides ready access).

***Table 2: Design life of components and sub-systems from ABCB Handbook[16].***

| Design life of building (*dl*) (years) | | Design life of components or sub-systems (years) | | |
|---|---|---|---|---|
| | | Category | | |
| Category | No. of years | Readily accessible and economical to replace/ repair | Moderate ease of access but difficult or costly to replace or repair | Not accessible or not economical to replace or repair |
| Short | 1<*dl*<15 | 5 or *dl* (if *dl*<5) | *dl* | *dl* |
| Normal | 50 | 5 | 15 | 50 |
| Long | 100 or more | 10 | 25 | 100 |

With respect to fire-retardant coatings, the design life of a coating may vary from that of the timber element forming the substrate.

If the fire-retardant coating is treated as a component in its own right then an appropriate design life for the coating should be between 5 and 15 years based on Table 2 depending on ease of access and cost or repair (reinstatement).

If the fire-retardant coating is treated as an integral part of the substrate then the reinstatement of the performance of the coating would be considered a maintenance activity. In these circumstances, if it was considered uneconomical to replace or repair the timber element forming a substrate (e.g. a loadbearing column), a design life of 50 years may apply to the column assembly, but reinstatement of the fire-retardant coating should be undertaken as a routine maintenance task and it is reasonable to base the periods for this activity on Table 2 (i.e. 5 or 15 years).

In most instances the minimum design life required for a fire-retardant coating system should be either 5 or 15 years depending on the accessibility and cost of reinstatement of the required performance of the fire properties of the coated element.

## Factors Affecting Durability

The ABCB Handbook identifies a broad range of factors that may have a bearing on durability that should be considered when determining whether a component will have adequate durability; which are summarised below together with additional items relevant to fire-retardant coatings.

**Environmental agents**

- temperature
- solar radiation
- humidity
- rainfall
- wind and airflow
- soil type
- exposure to airborne salt
- pollutants
- saline environment
- biological agents
- chemical effects, etc.

**Specific conditions**

- condensation
- cyclic changes (e.g. from hot to cold or wet to dry)
- agents due to usage, (e.g. aggressive, inappropriate maintenance or agents)
- ground contact.

**Actions by users**

- direct use caused by heavy use (e.g. foot traffic on floors)
- accidental impacts
- spilled chemicals
- internal processes (e.g. laundries).

**Design, Detailing and Workmanship**

- prevention or reduced exposure to elements (e.g. containment of corrosive agents)
- overhanging eaves to reduce exposure to weathering
- detailing to avoid pooling and run off over surfaces
- detailing to avoid abrasion and impact damage
- surface preparation and condition of substrate at the time of application of a coating
- treatment at joints and connections
- compatibility with other treatments.

The ABCB Handbook identifies three strategies to achieve the required performance through the design life of a structure as shown in Figure 7.

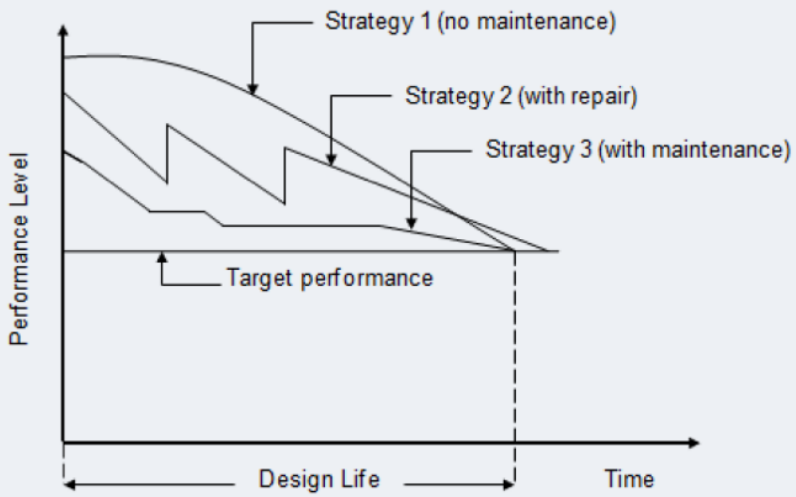


***Figure 7: Strategies to achieve the required performance from ABCB Handbook[16].***

To achieve the fire hazard properties required by the National Construction Code (NCC) a maintenance process is required in most jurisdictions. Many jurisdictions reference AS 1851[22], which requires annual inspections of fire and smoke barriers and fire-resistant structural members protected by coatings. It is appropriate to apply the same requirements to fire-retardant coatings for timber elements. Therefore Strategy 2 or Strategy 3 should be adopted for fire-retardant coatings applied to timber.

When designing for durability the ABCB Handbook indicates the following factors should be considered:

- intended use of the structure or system
- required performance criteria
- expected environmental conditions
- composition, properties and performance of the materials
- structural system
- shape of the members and the structural detailing
- quality of the workmanship and level of control
- particular protective measures
- maintenance during the design life.

For fire-retardant coatings used within the scope of this CoP the required performance criteria relate to fire properties which are expected to be determined in accordance with the NCC based on the intended use of a structure and to the degree necessary the structural system.

Shape of the members and structural detailing is addressed to the degree necessary in relation to fire properties through the performance criteria and referenced fire tests which vary to some extent with the orientation and use of the lining / cladding system being considered.

Typically environmental conditions for fire-retardant coatings can be classified as:

- internal conditions (e.g. fire-retardants applied in situ after structure is watertight)
- protected external conditions (semi exposed) (i.e. protected from contact with rain by horizontal projections and reduced exposure to UV radiation)
- external conditions (full exposure to weather).

Additional criteria may apply depending on the application such as exposure to chemicals, salt spray, abrasion (e.g. flooring), contact with external ground.

The composition, properties and performance of specific fire-retardant coatings will vary between products and the suppliers / manufacturers will need to consider, issues such as quality of the workmanship and level of control; supplementary protective measures; and maintenance / reinstatement procedures for the products they manufacture and / or supply.

## Assessment of Durability

A general procedure for the assessment of durability is specified in the ABCB Handbook requiring the following tasks to be undertaken applying sound engineering / scientific principles with some assessment of the reliability of the proposed solution.

(a) identify the service conditions;

(b) identify the relevant environmental agents and specific locations that contribute to the problem (see Section 4.1 of this Handbook);

(c) identify the deterioration and damage mechanisms;

(d) identify the relevant factors to be considered (see Section 4.2 of this Handbook);

(e) identify the relevant limit states associated with the functional failures for the intended use;

(f) estimate the deterioration-time relationship; and

(g) determine whether the anticipated deterioration is acceptable or the building components or assemblies need to be maintained, repaired or replaced within the design life of the building.

Tasks (a) and (b) should be undertaken as part of the design / specification process of a typical building or structure.

Task (e) is inherently addressed through the specification of NCC Deemed-to-Satisfy fire safety related provisions that prescribe test methods and related performance criteria that components / elements of construction need to satisfy. If a Performance Solution is adopted relating to the fire safety provisions of the NCC, then as part of the analysis the probability and consequence of system failures should be considered.

Normally the product supply chain, comprising the product designer, manufacturer, distributor / importer and supplier will be responsible for ensuring the remaining tasks are adequately addressed; since they have responsibilities to ensure the product is fit for purpose and also have access to historic data, formulation details and evaluations of durability undertaken for other markets.

Appropriate evidence of suitability should be provided by the supply chain to the relevant building designer(s) and building certifier using one or more of the following assessment methods, specified in the ABCB Handbook:

- historical record
- modelling
- testing
- specialist expertise.

## Established Test Procedures for Pre-fire Test Weathering of Specimens to Assess Durability

The following describes accelerated weathering test procedures that may be used as part of the determination of the durability of fire-retardant coated wood products. It is not written in mandatory terms since details of the historic record and previous evaluations, design exposure conditions and knowledge of materials used in the formulation of a coating system will vary and may be more reliable than accelerated weathering tests.

Notwithstanding the above, for unprotected external use it is mandatory to undertake accelerated weathering tests prior to fire testing when evaluating bushfire-resisting timber that relies on fire-retardant coatings to achieve the required performance in accordance with AS 3959.

It is important for the exposure of an element during accelerated weathering tests to reflect the end use. Advice on the preparation of specimens is provided in Appendix B.

## AS 3959 Requirements for Accelerated Weathering Test

Appendix F Para F2(b) of AS 3959 states the following:

“Where the timber has been altered by chemicals, the test samples shall be subjected to the regime of accelerated weathering described in Paragraph F3 except that where the timber is protected from the weather, as described in the AS 1684 series (for example, cladding protected by a veranda), accelerated weathering of the test samples is not required before being tested to AS/NZS 3837.

External timbers are deemed to be protected if they are covered by a roof projection (or similar) at 30 degrees or greater to the vertical and they are well detailed and maintained (painted or stained and kept well ventilated).”

Appendix F Para F3 of AS 3959 states: “Where accelerated weathering is required before testing to AS/NZS 3837, external fire-retardant coated substrates shall be subjected to the ASTM D2898 Method B weathering regime, with the water flow rate modified to be the same as that within ASTM D2898 Method A.”

This provides a benchmark in that accelerated weathering tests are not required for semi-exposed external conditions. Only fully exposed external conditions and an external weather testing protocol have been specified.

Since no design life is specified in AS 3959 it should be assumed that the design life of fire-retardant coatings evaluated under these conditions is the minimum recommended in the ABCB Handbook (i.e. five years unless additional evidence for the specific coating system is available).

## General Accelerated Weathering and Fit for Purpose Assessment Methods

### ASTM D2898

The accelerating weathering tests specified in ASTM D2898[18] are commonly used internationally and, since they are adopted by an NCC referenced standard for accelerated weathering tests on bushfire-resisting timber, it would be reasonable to adopt this method as part of an assessment of durability for fire-retardant coatings used externally based on the regime described in AS 3959 and summarised below:

Specimens should be subjected to the ASTM D2898 Method B weathering regime, with the water flow rate modified to be the same as that within ASTM D2898 Method A.

### ETAG 028

ETAG 028[23] is a Guideline for the European Technical Approval of Fire-retardant Products (including fire-retardant coatings). It provides the basis for the preparation of European Technical Approvals, which are defined as technical assessments of the fitness for use of a construction product and technical specification of assessed products. ETAGs serve as the basis for CE marking when and where harmonised standards are not yet available.

While the fire test standards and related fire performance criteria specified in ETAG 028 are not directly applicable to the NCC, the ETAG includes detailed procedures for the assessment of the working life and other criteria relating to fitness for purpose of fire-retardant coatings. The ETAG assumes a working life of five years when the product is installed, subject to appropriate installation use and maintenance. This criterion is consistent with the durability criteria provided in the ABCB Handbook. The provisions in the ETAG were based on the current state-of-the-art knowledge and experience and form a useful basis for assessment of durability.

In summary: Annex B of ETAG 028 provides details of test and assessment methods to determine the durability of reaction to fire performance.

If fire-retardant coatings are applied to flooring, the performance is required to be verified after being subjected to abrasion testing.

Cone calorimeter testing is used to compare the performance of the coating before and after exposure to the durability tests and, if appropriate, abrasion tests even though cone calorimeter method is not used for the initial classification. The irradiance levels are specified depending upon the application. The total heat released is calculated over a 10 minute period. Average values are then calculated for the samples not exposed to durability testing and samples exposed to durability testing. The total heat released for the samples after durability testing must not increase by more than 20% above the value obtained from the specimens not exposed to durability testing. In addition the rate of heat release rate averaged over a 30s periods is calculated and maximum limits are specified, depending on the application. These heat release rate limits are independent of the initial test series.

## Use of Cone Calorimeter Tests for Evaluation of Performance after Weathering / Durability Testing and Repair

### Direct Determination of Classification after Weathering / Durability Testing

The requirements for bushfire-resisting timber in AS 3959 include procedures for evaluating the performance of coating systems after exposure to accelerated weathering using cone calorimeter testing in accordance with AS/NZS 3837.

In many instances the *group number* for wall and ceiling linings is permitted to be derived from cone calorimeter tests performed in accordance with AS/NZS 3837 or ISO 5660-1. In these cases, it is possible to predict the results directly from specimens cut from samples exposed to accelerated weathering if external exposure is expected. Refer Appendix B for preparation of specimens.

### Determination of Acceptable Levels of Performance after Weathering / Durability Testing

It is impractical to undertake the accelerated weathering / durability testing of large or intermediate scale samples in order to evaluate the fire properties of fire-retardant coated wood products. In these circumstances comparison of the performance of the coating applied to a substrate before and after weathering / durability testing using cone calorimeter test methods provides a practical solution. This approach is adopted in ETAG 028.

Variability in results is expected and the standard cone test procedures require testing of more than one specimen in recognition of this variability. In addition most of the test / classification methods considered in this code specify pass/fail criteria that have to be met or exceeded and therefore in most instances there will be a safety margin. This is addressed to some extent in the ETAG procedure where the results from different samples are averaged and a 20% increase in the total heat released is permitted.

Irradiance levels of 25kW/m$^2$ and 50kW/m$^2$ are commonly used in Australia and ETAG 028 uses values of 30kW/m$^2$ and 50kW/m$^2$. The following irradiance levels are suggested to be used for comparative purposes and have been selected based on the commonly used levels.

***Table 3: Suggested Cone Calorimeter irradiance levels for comparison of fire-retardant coating before and after durability testing***

| Classification test method | Comparative test irradiance level – kW/m$^2$ |
|---|---|
| AS ISO 9705 | 50 |
| AS ISO 9239.1 | 25 or 30 |
| AS 1530.3 | 50 |
| AS 1530.8.1 BAL 12.5,19 and 29 | 25 or 30 |
| AS 1530.8.1 BAL 40 | 50 |

## Overpainting Repair and Reinstatement

Cone calorimeter testing may be undertaken to evaluate options for overpainting repair or reinstatement of the performance of a coating at the end of the design life.

A test program should be developed in conjunction with the accredited testing laboratory to investigate the impact of events such as overpainting, damage and subsequent reinstatement to form the basis for the manufacturer's instructions.

## Evaluation of Options at the End of the Design Life

At the end of the stated design life of the coating, there are a number of options that may be appropriate subject to verification of performance. Typical examples include:

- sanding back and reapplication of the entire system
- application of additional coat(s) of fire-retardant over existing coatings
- extending the life of the coating based on natural aging tests.

Cone calorimeter testing may be undertaken to evaluate options for extending the life of the design life of the coating system or repair / reinstatement to bring the performance up to required levels of performance.

# 5 Building Design and Product Specification

**The design team is responsible for the specification of the components of a building to ensure the building achieves the design objectives, complies with relevant legislation and can be constructed and maintained safely. While product suppliers and companies and individuals associated with the product supply chain also owe a duty of care to ensure a product is fit for purpose, the specification provided by the design teams needs to include such things as:**

- Clear description of the extent of services to be provided
- Expected service conditions
- Design Life
- Maintenance and repair / re-instatement (including access for maintenance and inspection activities in the completed structure)
- Details of the substrate (wood product) and backing materials if provided
- Surface preparation and installation requirements
- Required finish to be achieved
- Conditions and potential constraints of the site
- Co-ordination of site activities
- Workplace Health and Safety
- Regulatory requirements (e.g. performance required to satisfy the NCC)
- Other technical requirements and applicable standards (e.g. VOC limits)
- Compliance with other applicable policies
- Verification of compliance
- Evidence of suitability
- Applicable Quality Control and Quality Assurance Provisions including requirements for a declaration of performance from the manufacturer / supplier and required site inspections during installation.

# 6 Product Design and Development, Manufacturing, Supply and Evidence of Suitability

## Product Design and Development

Fire-retardant coatings should be designed to be fit for purpose and a statement should be developed clearly stating the design objectives and intended purpose, design life and conditions that have to be satisfied for the design objectives to be satisfied.

Analysis and testing should be undertaken to determine that the design objectives will be satisfied throughout the design life of the system and to provide appropriate evidence of suitability that support the stated claims in literature and declarations of performance.

## Quality Assurance

Manufacturers of fire-retardant products need to implement and maintain quality control systems that monitor the production of their products to ensure that the performance of the supplied products is capable of achieving the same performance as specified in their literature and declarations of compliance.

The Quality System should include procedures to ensure that products are not substituted or modified prior to installation and that installation contractors have received adequate training and are competent in the application of the coating including preparation of the substrate.

## Labelling and Identification on Product Containers

Labelling on the product containers should include the following in addition to information required by other relevant legislation such as WHS regulations. The labelling should be in English and clearly legible supported by pictograms where appropriate.

- a unique identifier of the product that clearly differentiates the product from similar materials provided by the manufacturer / supplier
- colour of product
- batch number and date of manufacture
- intended use or uses of the product
- performance of the product when applied to nominated substrates or reference to a data sheet containing this information
- application instructions including details of compatible primers and top coats, drying time, recoating time, required wet and dry film thicknesses, and theoretical coverage or reference to a data sheet containing this information
- use by date
- the name, Australian address and business telephone number of either the manufacturer or importer / supplier
- any information about the hazards, first aid and emergency procedures relevant to the product and reference to a Safety Data Sheet
- storage instructions.

## Product Data Sheet

Product Data Sheets should be provided and contain as a minimum the following information in addition to information required by other relevant legislation:

- the name, Australian address and business telephone number of either the manufacturer or importer / supplier
- unique identifier of the product that clearly differentiates the product from similar materials provided by the manufacturer / supplier
- colour range of product
- intended use or uses of the product
- general physical properties
- general application, typical drying time and recoating times, required wet and dry film thicknesses, and theoretical coverage
- details of compatible primers and top coats
- surface preparation requirements
- general application requirements
- available finishes
- safety precautions (including reference to Safety Data Sheet)
- performance of the product when applied to nominated substrates or reference to the Declaration of Performance containing this information including reference to evidence of suitability as required by the NCC
- approximate VOC concentrations
- storage instructions
- design life of installed system
- inspection and maintenance procedures
- end of design life procedures.

## Declaration of Performance

### General Declaration of Performance

The manufacturer must provide a declaration of performance of their product clearly stating the performance and referencing appropriate evidence of suitability on which the statement is based.

The declaration should be on company letter head and signed on behalf of the company by a director or authorised delegate.

The declaration must contain as a minimum the following:

- the name, registered trade name or trade mark, contact address, business telephone number, of the manufacturer. If the product is supplied through an importer / supplier other than the manufacturer the same details should be supplied for the importer / supplier
- unique identifier of the product that clearly differentiates the product from similar materials provided by the manufacturer / supplier
- intended use or uses of the product
- performance of the product when applied to nominated substrates including reference to evidence of suitability as required by the NCC
- durability performance including design life for nominated exposure conditions including reference to supporting evidence
- requirements for primers / top coats and coating thicknesses to achieve the stated performance
- approximate VOC concentrations (if low VOC content is claimed)
- details of any known hazards associated with the use of the product and reference to the Safety Data Sheet.

## Project Specific Declaration of Performance

For major and or critical projects, a project specific declaration may be requested from a manufacturer / supplier. In these instances the manufacturer/supplier will:

- review the schedule of the supplier works required
- nominate the coating system to be used to achieve the required performance and design life having regard for the exposure conditions
- undertake training of the applicators or determine by other means that the applicator is competent to undertake the installation in accordance with the manufacturer's instructions
- check that adequate materials have been supplied to the contractor to undertake the project
- undertake inspections to check installations
- provide a project specific declaration that includes the information required in the general declaration of performance plus the following:
  - a schedule of protected elements with a clear statement of the performance required for each element and the coatings applied
  - confirmation that training or a competency assessment has been undertaken of the applicators to ensure they have the necessary competencies to install the products in accordance with the instructions
  - sufficient materials have been supplied to the contractor to complete the project
  - details of the inspections undertaken and observations made
  - a statement that based on investigations undertaken it is considered likely that the performance listed on the schedule will be achieved for the nominated design life subject to maintenance of the system in accordance with the nominated maintenance procedures

If a manufacturer / supplier lacks sufficient knowledge and documentation to support the above claims they should obtain the necessary information from the product designer. For smaller projects, where this level of involvement may be impractical, the installation should be monitored by a nominated member of the building design team and the necessary checks undertaken by that person. The use of installers recommended by the manufacturer / supplier under these circumstance would be prudent.

## Installation Instructions

Installation instructions should be provided and contain as a minimum the following information in addition to information required by other relevant legislation:

- product storage instructions
- checks to ensure correct materials are used
- environmental conditions for application
- surface preparation and surface condition required for application
- primer requirements
- fire-retardant coating installation requirements and methods.
- required coating thickness and methods of verification
- top coat requirements
- finishing requirements
- potential installation defects and rectification methods
- repair methods if coating system is damaged
- clean up procedures including disposal of excess materials
- workplace health and safety precautions including reference to a Safety Data Sheet.

## Evidence of Suitability / Compliance

Notwithstanding the requirement to provide a general declaration of performance it is still necessary to provide evidence of suitability in accordance with the requirements of the relevant regulations and standards such as the National Construction Code to the satisfaction of the relevant regulatory authority. This information will also be required by Building Owners at some stage who have a responsibility to check the building complies with regulations and undergoes regular maintenance checks.

Typical evidence of suitability may include the following:

- report from an Accredited Testing Laboratory confirming fire performance
- report supporting the claimed design life
- Safety Data Sheet
- other supporting data relevant to claims made in the declaration of performance.

# 7 Installation of Fire-retardant System

## General Requirements

Fire-retardant coatings must be installed by persons trained by the product manufacturer or their representatives, or a nominated training organisation with the necessary knowledge of the specific products.

The installer should be provided with a specification, schedule of elements to be treated and required performance and associated drawings. This should be reviewed by the building certifier or authority having jurisdiction and a design team member to confirm the specified performance satisfies the relevant regulatory requirements and client brief.

The installer should review the schedule and confirm a coating system that will achieve the required performance, if necessary checking with the manufacturer, design team and building certifier.

A quality plan should be developed and installation program established by the installer in conjunction with the appropriate building design team member(s) and the authority having jurisdiction and builder to ensure compliance with the manufacturer's instructions. The quality plan must include details of inspections and verification requirements for coating thicknesses.

The installer must also comply with site WHS requirements and dispose of excess materials in accordance with the manufacturer's instructions and relevant legislation.

The installation must comply fully with the manufacturer's instructions. If there are any variations, the matter should be referred to the manufacturer in the first instance who may need to refer the matter to a registered testing authority for confirmation.

## Declaration of Compliance of Installation / Schedule of Installed Product

Upon completion, the schedule of fire-retardant protected elements and drawings should be updated to clearly identify the protected areas, coatings applied including thickness, batch number and date applied and required performance and design working life. This should be appended to a declaration of compliance providing a statement that the installation has been undertaken in accordance with the manufacturer's instructions with the product and product thicknesses nominated on the attached schedule.

The declaration should be on company letter head and signed on behalf of the company by a director or authorised delegate and include the name, registered trade name or trade mark, contact address, business telephone number, of the installer and any applicable company or individual registrations.

Copies of this declaration should be provided to the building certifier, builder and design team for subsequent inclusion in a maintenance schedule and fire safety manual for the building which should also include the manufacturers instructions regarding maintenance and any restrictions on overpainting. Copies of the maintenance schedule and fire safety manual should be provided to the building owner.

# 8 Inspection and Maintenance

**The NCC and Building regulations applicable in the States and Territories apply different requirements for the maintenance of fire safety provisions in domestic construction (Class 1 buildings) compared to commercial buildings (Class 2 to 9 buildings).**

## Inspection and Maintenance of Class 1 buildings

For Class 1 buildings, the main application for fire-retardant coatings is for bushfire protection in accordance with AS 3959 and there are generally no mandatory requirements for annual inspection and maintenance of fire safety provisions. It is important that building owners are made aware of the need for annual inspection and maintenance of fire-retardant coatings and actions to take at the end of the design life of the coating.

It is recommended that a schedule of fire-retardant treated elements and maintenance procedures are provided and kept in the meter box or other safe storage position readily accessible so that they are available to future residents.

## Inspection and Maintenance of Class 2 to 9 buildings

For Class 2 to 9 buildings a maintenance process is required in most jurisdictions. Many jurisdictions reference AS 1851 which requires annual inspections of fire and smoke barriers and fire resistant structural members protected by coatings and it is therefore appropriate to apply the same requirements to fire-retardant coatings for timber elements. Therefore annual inspections should be undertaken as a minimum in addition to any additional requirements specified by the manufacturer.

As a minimum, the annual inspection should undertake the following activities in addition to any other activities specified by the manufacturer:

- refer to the schedule / fire safety manual to determine the extent of fire-retardant wood products, coating requirements and design life
- check if the design life has been exceeded – if it has initiate the end of design life procedures
- inspect the elements for any damage unauthorised over-painting and modification. If damage or over-painting is identified, require repair in accordance with the manufacturer's procedures.

## End of Design Life Procedures

At the end of the design life of fire-retardant coating it is necessary to either verify that the performance of the system still satisfies minimum regulatory requirements or repair / reinstate the performance in accordance with manufacturer's instructions, which should be based on evidence of suitability from an Accredited Testing Laboratory. Typically, the design life may be extended on the basis of:

- Accelerated weathering / durability testing justifying the extension in design life
- Field testing / experience in the use of the system
- Testing samples taken from the building that have been exposed to similar environmental conditions. These samples may be taken from elements of construction or from samples prepared at the time of installation that have been retained on the site and exposed to similar environmental conditions.

In most instances small-scale cone calorimeter testing will provide appropriate data. The results should be reviewed by a registered testing authority and a revised design life estimated. Confirmation of the extended design life should be recorded on the maintenance schedule and building fire safety manual in the form satisfying the NCC requirements for evidence of suitability (e.g. a report from an Accredited Testing Laboratory).

# Appendix A: Definitions

**Fire-retardant coating:** A coating supplied in liquid, paste or powder form that when applied to a substrate, improves one or more of the fire performance characteristics of the substrate.

**Intumescent coating:** A coating that is specifically formulated to provide a chemical reaction upon heating such that the physical form changes into an expanded foam and, in so doing, provides protection to the underlying surfaces from fire.

**Encapsulation coating system:** A coating system that completely encases a surface.

**Surface treatments:** A product in liquid or paste form that, when applied to a substrate, penetrates below the surface and, on drying or curing, deposits substances that impart fire-retardant properties to the substrate.

**Durability:** The capability of a building or plumbing installation to perform its function over a specified period of time.

**Design life:** The period for which a building or component of a building is expected to fulfil its intended function assuming regular maintenance will be carried out and that there will be no unusual events such as a large earthquake.

**Maintenance:** The total set of activities performed during the design life to retain a building installation in a state in which it can fulfil its intended function. Routine inspection activities are included within this definition of maintenance.

**Product Supply Chain:** includes individuals and entities responsible for any of the following; design, manufacture. importation, distribution / supply and installation of a product.

**Repair:** activities performed to return a building or building component to an acceptable condition. The activities may include raising the performance level, extending the design life, and making good any damage that impairs the original functioning and design life of a component. Maintenance may lead to repair.

**Reinstatement (of fire properties):** activities performed to ensure that the relevant fire properties of the element comply with the performance specified at the time of design and construction in order to comply with the National Construction Code, other relevant legislation and performance specifications.

# Appendix B: Specimen Preparation for Accelerated Weathering Tests

The accelerated weathering specimen size must be the same as for the subsequent fire testing or preferably larger but with a minimum size along the grain of 800 mm.

The application of fire-retardant coating must be representative of the end use (i.e. if only one face is treated with a fire-retardant coating then only one face of the specimen should be treated with the coating).

The exposure to weathering must be representative of the end use (i.e. if only one face is exposed to weathering then only one face of the specimen should be exposed to accelerated weathering).

If edges perpendicular to grain are not intended to be exposed to weather the edges are to be sealed. A suitable seal consists of a thin coat of alkyds primer and a thick top coat of silicon sealer. If the rear face is not to be exposed to weathering, it may be covered by an impermeable membrane adhered to the specimen such as polyethylene.

The timber thickness should be representative of the end use.

Where small-scale fire testing is performed e.g. in the cone calorimeter (AS 3837), cut the specimen for fire testing ≥100 mm from the sealed edge of the exposed board, after accelerated weathering.

# References


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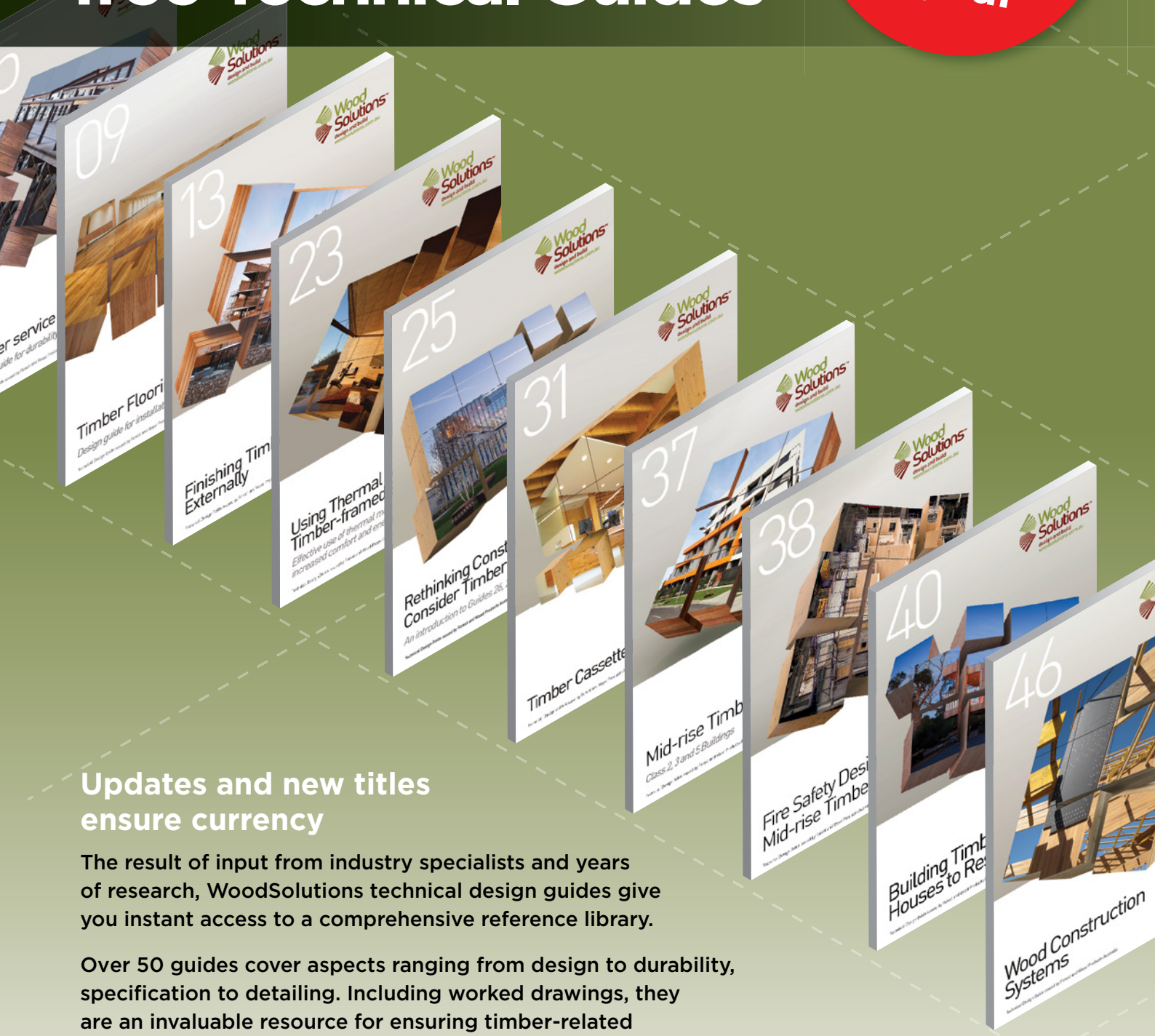


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